

CLAIMS

1. A method of depositing one or more elements on a substrate, the method comprising the steps of:
  1. providing a donor compound suspended in a carrier gas, the donor compound including the one or more elements for deposition;
  2. passing the carrier gas with the suspended donor compound over the substrate so as to form a film of the donor compound on the substrate; and
  3. irradiating the donor compound with optical radiation having an intensity sufficient to cause deposition of the one or more elements onto the substrate through photochemical decomposition of molecules of the donor compound within the film formed on the substrate,  
wherein the intensity of the optical radiation is insufficient to cause significant photolytic breakdown of molecules of the donor compound that are suspended in the carrier gas.
2. The method of claim 1, wherein the step of providing a donor compound comprises the sub-step of providing the donor compound at a temperature substantially equal to an average temperature of the substrate.
3. The method of claim 1, wherein the film formed on the substrate is less than 50 monolayers thick.
4. The method of claim 1, wherein the film formed on the substrate is less than 5 monolayers thick.
5. The method of claim 1, wherein the donor compound comprises of chromium hexacarbonyl.

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6. The method of claim 1, wherein the donor compound consists essentially of chromium hexacarbonyl.
7. The method of claim 1, wherein the donor compound comprises dimethylgold-trifluoro acetylacetone.
8. The method of claim 1, wherein the optical radiation has a wavelength greater than 350 nanometers.
9. The method of claim 1, wherein in the passing step, the carrier gas is passed over the substrate at a rate that causes it to have a laminar flow over the substrate.
10. The method of claim 1, wherein in the passing step, the carrier gas is passed over the substrate at a rate that causes formation of the film of the donor compound on the substrate that is a few monolayers thick.
11. The method of claim 1, wherein the optical radiation has a peak intensity of at least about 5 Gigawatts per square centimeter.
12. The method of claim 1, wherein the step of irradiating includes the sub-step of using a laser source to generate radiation with a wavelength of 400 nanometers.
13. The method of claim 1, wherein the optical radiation has a wavelength between 200 and 300 nanometers.
14. The method of claim 1, wherein the step of irradiating is performed for a duration that is not long enough to cause thermally induced decomposition of the donor compound.

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15. The method of claim 1, wherein the intensity is sufficient to initiate decomposition of the donor compound by a nonlinear two photon absorption process.

16. The method of claim 1, wherein the optical radiation has a peak intensity of at least about 50 Gigawatts per square centimeter.

17. The method of claim 16, wherein the step of providing a donor compound comprises the sub-steps of:

flowing a carrier gas in contact with a solid donor compound to generate a mixture of donor compound vapor and carrier gas; and

flowing the mixture over the substrate.

18. The method of claim 16, wherein the donor compound consists essentially of dimethylgold-trifluoro acetylacetone.

19. The method of claim 16, wherein the donor compound comprises one or more compounds selected from a group consisting of tungsten hexacarbonyl, molybdenum hexacarbonyl, aluminum hexafluoroacetylacetone, and platinum (ii) hexafluoroacetylacetone.

20. The method of claim 1, wherein the step of providing a donor compound comprises the sub-steps of:

flowing a carrier gas in contact with a solid donor compound to generate a mixture of donor compound vapor and carrier gas; and

flowing the mixture over the substrate.

21. The method of claim 20, wherein the sub-step of flowing the mixture comprises flowing the mixture over the substrate at a velocity of at least about 5 cm/second.

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22. The method of claim 20, wherein the sub-step of flowing the mixture comprises flowing the mixture over the substrate at a velocity of at least about 50 cm/second.

23. A method of depositing at least one element on a substrate, the method comprising the steps of:

providing a donor compound suspended in a carrier gas, the donor compound including the element for deposition;

passing the carrier gas with the donor compound over the substrate so as to form a film of the donor compound on the substrate; and

irradiating the donor compound with optical radiation so as to cause deposition of the element onto the substrate through photochemical decomposition of molecules of the donor compound within the film on the substrate,

wherein the optical radiation has a pulse width that does not cause thermal absorption by the element so as to prevent thermally induced breakdown of the donor compound.

24. The method according to claim 23, wherein the pulse width has a duration of less than about 125 femtoseconds.

25. The method according to claim 23, wherein the pulse width has a duration of less than 1 picosecond.